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Title

Reflecting a decade of Russia's transition: What can be extracted for the nearest future?

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ABSTRACT

This paper is an extraction of some results achieved in a comprehensive study of Russia's transition in its regional as well as sectoral dimension. Thereby, the transition process between 1993 – 2000 has been approximated by aggregated developments of productivity, technical change, and technical efficiency which all have been calculated by a *Stochastic Frontier Analysis* (SFA). The obtained results have been analyzed with respect to any institutional circumstances in a second analytical step. Based on that, in a third step, some political call for actions have been specified as well as addressed according to a regional/federal responsibility.

The study has shown a notable heterogeneity within the considered regional as well as sectoral transition paths. Occasionally, the individual trends even diverge and provide, however, a growing economic polarization among Russia's regions. Background of these trends are, above all, spatial divergent institutional conditions caused by various reform implementations and/or reform strictness. Hence, the crucial call for political action had to be addressed regionally. At federal level, just coordinating and flanking measures have been mentioned.

Altogether it can be summarized: The necessary pre-conditions for a successful transition in Russia seem to be given. But there is apparently a need in some regions for an adequate individual adjustment as well as, sometimes, for a sustainable stimulus in order to trigger a change. Hence, the particular embodiment of the regional transition path, the political initiative, and, therefore, any success on Russia's way from a 'planned towards a market economy' are incumbent on the regions. Admittedly, those have to be aware of own potentials. The regions should develop their individual chances actively and, however, try to turn specialties into benefits. Since this will be successful, it can be a source of substantial growth at regional as well as at federal level.

ZUSAMMENFASSUNG

Dieses Papier ist eine Extraktion der Ergebnisse einer umfassenden Studie des russischen Transformationsprozesses in seiner sektoralen sowie regionalen Dimension. Dabei wird der Transformationsverlauf zwischen 1993 – 2000 anhand regional aggregierter Produktivitätsentwicklungen bzw. der von Technischer Effizienz sowie technischen Wandels approximiert. Die Ergebnisse der dazu eingesetzten *Stochastic Frontier Analyse* (SFA) werden dann in einem zweiten Analyseschritt im Rahmen einer Regressionsanalyse auf deren (v.a. institutionelle) Hintergründe hin untersucht, bevor wiederum darauf aufbauend entsprechender reformpolitischer Handlungsbedarf formuliert sowie regional bzw. föderal adressiert wird.

Die Studie offenbart sowohl sektoral als auch regional ausgesprochen heterogene Entwicklungspfade; bisweilen divergieren diese gar und führen zu ökonomischer Polarisierung der Regionen. Hintergrund davon sind v.a. differierende institutionelle Rahmenbedingungen, die primär aus regional individuellen Reformimplementierungen resultieren. Bei der Erörterung des sich daraus ableitenden Handlungs-, Präzisierungs- bzw. Diskussionsbedarfs zeigte sich, dass der überwiegende Teil des akuten sowie des perspektivischen Politikbedarfs bei den Regionen Russlands liegt. Für die föderale Ebene ergeben sich v.a. koordinierende sowie flankierende Maßnahmen.

Insgesamt lässt sich festhalten: Die notwendigen Bedingungen für eine erfolgreiche Transformation Russlands scheinen überall gegeben; es fehlt aber mancherorts an den qualitativ hinreichenden sowie an positiven Impulsen. So liegt die Gestaltung des Transformationspfades, die politische Initiative und damit auch der Erfolg auf Russlands Weg vom "Plan zum Markt" primär in den Regionen. Hier muss man sich der eigenen

Möglichkeiten bewusst werden, diese aktiv entwickeln und nutzen. Gelingt dies, dann kann daraus substantieller wirtschaftlicher Aufschwung erwachsen.

1 Introduction: Idea, Objectives and Approach of the Analysis

Facing more than ten years of *Russia in Transition* it seems to be possible as well as necessary to analyze the process of change, the current stage of transition, and the problems came up so far. In order to analyze this, however, one has to visualize the changes and, moreover, to explore their determinants. Thereby, some challenging questions have to be solved, like e.g.: How to capture the complexity of transition in empirical models and what could be a suitable benchmark for progress in transition?

These questions are some of the central aspects in a comprehensive research project carried out in the IAMO[1]. This paper is going the present the projects' analytical concept in brief as well as – in an overview – some selected results.[2] The project is based on the idea that individual progress on the way from a planned economy to market oriented one can be approximated by measuring productivity and/or efficiency of the observed units (regions). Thereby, a characteristically positive trend was expected triggered by positive incentives and/or stimulating effects e.g. due to liberalization, increasing competitiveness.[3] This has been analyzed empirically by estimating regional differentiated production frontier functions. Beside Russia's economy as a whole (general benchmark), agriculture, industry, service sector as well as construction sector have been considered separately (scores of technical efficiency, technological progress, and total factor productivity were calculated). Based on that, the determining variables of the individual (regional) measures have been investigated in a second analytical step. Finally, in a third step, regionally focused policy recommendations have been made and addressed with respect to the corresponding political responsibilities (regional or federal level).

In the current paper some of the project' results will be presented. By focusing on the regional dimension of Russia's transition process three general questions are considered: (1) What are the common sectoral trends? (2) What institutional needs are obvious and (3) who is responsible – the recipient – for these?

The paper is structured as follows: In the subsequent chapter II the analytical approach will be discussed in brief. Chapter III illustrates the database. In chapter IV some selected sectoral tendencies will be discussed. Due to the limited space of this paper this will be restricted to focus on (1) economy as whole and (2) agriculture only. Furthermore, some related remarks according the general political needs will be made. Chapter V provides a conclusion.

2 Methodology

In order to analyze the transition process by considering developments in productivity and efficiency – like mentioned above – one has to estimate the frontier of the productions possibility set (e.g. by sector). All observations are then

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1 Institute for Agricultural Development in Central and Eastern Europe (title translated), Halle (Saale).

2 VOIGT (2003): Russlands Weg vom Plan zum Markt: Sektorale Trends und regionale Spezifika.

3 For more detailed discussion see for example VOIGT and UVAROVSKY (2001).

considered in relation to that. For doing this, two approaches are established: (1) the non-parametric Data Envelopment Analysis (DEA), and (2) the parametric Stochastic Frontier Analysis (SFA). By considering the strength and limitations of both methodologies for the current analysis the SFA has been selected.[4]

Accordingly, for each of the considered sectors a frontier function of the form $[y_{it}=f(x_{ijt},\beta) + v_{it} - u_{it}]$ had to be estimated with *i*–regions, Y=output, X=inputs (j=1,2,...,N), β as vector of parameters has to be estimated, *v* as stochastic term with $[v_{it} \sim N(0,\sigma^2]$ and u_{it} as a non-negative error term, which refer to effects of inefficiency in the production process by representing the gap between the observed and the hypothetical (maximal) frontier output. Thereby, however, the Translog-form[5] for the production function and a truncated normal distribution for the u_i-term have been assumed.[6] For details see VOIGT (2004).

The individual Technical Efficiency $[TE_{it}]$ can be calculated by $TE_{it}=\exp(-u_{it})$. Scores for the individual Technological Progress $[TCH_{it}]$ can be obtained by calculating the partial derivatives of the frontier function with respect to time.[7] The product of basis-equivalent indices of TE and TCH represent a consistent index of the Total Factor Productivity $[TFP_{it}]$.

In order to go further into the question what variables play a determining role in Russia's regional transition process a comprehensive selection of categorical, structural, and institutional variables[8] has been regressed regarding the empirical results of the first analytical step (regional scores of TE, TCH by sector). Since the judgment call whether a certain variable affect TCH or TE sometimes a priori cannot be made a recursive two-equation regression model has been applied in order the parameterize and – if required – reduce the initial set of regressors.

Thereby, a series of variables were found what affect the transition process in general. Some others obviously just have sectoral specific impacts. The general institutional and/or political needs can be obtained by interpreting the causalities why a certain (significant) variable might influence the transition process and who is in charge of the individual characteristics of those variables? The latter is also the (primary) recipient for corresponding policy recommendations. Summarizing and screening of these aspects should implicitly provide a proposal for a suitable political agenda with a particular respect to individual enhancements of the regional reform process.

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4 See VOIGT (2004). According to the methodologies: COELLI et al (1998), KUMBHAKAR and LOVELL (2000).

5 In order to be sure about theoretical consistency every observation point has been tested for its curvature conditions (non-negativity with respect to the factor elasticities, and concave or quasi-concave with respect to the origin). For agriculture and economy as a whole all the observation fulfill these consistency criteria.

6 In some cases – after testing – the model was reduced to the special case of a half-normal distribution in u_i.

7 The time trend was implement as: t, t^2, $x_j t$. In accordance to COELLI et al. (1998) always the geometric mean of the partial derivatives of subsequent points in time have been calculated in order to avoid any bias. This results are considered to be the scores of regional TCH.

8 For example: Rain, temperature, ..., TE-scores of the other sectors, proxies for regional opening toward international markets, technological level, quality of infrastructure, availability of human capital, ..., stage of reforms (various approximations), regional environmental quality, ..., political majorities in the regional parliament, etc..

3 Database

The basic data set contains at regional level aggregated information about nearly all regions of Russia (75 of total 89 territorial units) for the period 1993 – 2000. All data are taken or derived from sources of the Russian Committee on Statistics (Goskomstat). During data collection, several major conceptual issues were faced: choice of appropriate proxies for inputs as well as regressor variables, consideration of differences in variables' attributes (e.g. input quality), adjustments on prices, and the problem of unbalanced panels (lack of data for several regions). In response to these issues, the data have been adjusted.[9]

[Y]-Output: Deflated values of production have been applied as sectoral output. The values for the economy as a whole were obtained by accumulating the given values of agriculture, industry, service, and construction sector.[10]

[X]-Inputs: In all sectors *Capital* (fixed assets)[11] and *Labor* (real paid wage sum) haven been used. In order to capture the specifics of agriculture for this sector *Land* (effective area weighted by soil quality) and *Intermediate Inputs* (purchased mineral fertilizer) were considered as inputs in addition.

[R_{TE}],[R_{TCH}]-Regressors: Due to the given restriction in space for this paper a particular description of the coherent regression framework has to be skipped. For details see VOIGT (2004). An overview of the implemented regressor variables and their statistical approximations is given briefly in Table 1 (appendix).

4 Results

The estimated parameters of the frontier functions for agriculture and for Russia's economy as a whole are given in Table 2 (appendix). Those of the related regression analyses are presented in Table 3 (appendix). Since the focus of this paper is more oriented on considering some common empirical trends than a broader discussion of certain econometric properties of the various models (e.g. the discriminating tests of hypotheses in order to get the final restricted models) this was neglected too.[12] But, it has to be mentioned that the numerical results of the various analyses were found to be robust even under different model specifications. Moreover, the criteria of theoretical consistency have been tested for every single observation point and were found to by fulfilled in any case. The coefficients seem to be plausible and within the expected range.

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[9] For more detailed description of the data adjustments see VOIGT (2004) or VOIGT (2003).

[10] Accordingly, these scores might differ from the statistical ones (what contains in addition e.g. military, etc.).

[11] Since no suitable data have been available the perpetual inventory method has been applied in order to construct 'hypothetically' fixed assets in use. Accordingly, starting with the corresponding Goskomstat' values for 1996 all other scores are given by an extrapolation of this value plus investments and minus depreciation (the latter was calculated too). See more detailed: VOIGT (2003) or VOIGT (2004).

[12] The frontier models, for example, were tested with respect to the existence of neutral TCH (linear / quadratic), non-neutral TCH, to be deterministic or stochastic, superiority of an OLS- vs. a frontier-function, constant returns of scale =1, homothecity of the function, fit of the functional form: Translog vs. Cobb-Douglas, ... For more details see again Voigt (2004).

Figure 1 (appendix) depicts the calculated scores for TFP, TCH (indices), TE (absolute) for every observed region (dots) as well as the related mean trends. The graphs illustrate a sometimes notable regional heterogeneity within the analyzed performance ratios. Since those estimates refer straight to the process of transition (approximation!) some eminent developments have to be mentioned: there are exceptionally positive as well as notable negative regional examples. Altogether it can be quoted: regionally diverging trends have led to a rising polarization among Russia's regions, in particular with respect to the regional TFP.

Before addressing the question of any reason behind those trends at institutional level a brief look at the sector aggregates can provide an interesting insight.

The TFP trend of Russia's economy in general, however, is heavily affected by macro-economic conditions (four phases: liberalization, hyperinflation, currency crisis, window of opportunity). Accordingly, it has turned up and down. For agriculture, this cannot be observed. Solely at the very beginning of the transition both TFP trends have had a similar shape (phase I). Thereafter, the common trends of the agricultural sector and Russia's entire economy split-up. Whereas for Russia's economy in general it seemed that the expected positive effects of the transition became true[13] (see argumentation above in the introduction) for agriculture no similar changes were observable. In an inter-sectoral comparison of "proceeding transition" Russia's agriculture lag behind.[14] And it seems that not even the window of opportunity – given like a second chance – was used to enhance the sectors' low performance and trigger the transition process. Indeed, a slight turn downwards in mean agricultural TFP had to be observed after 1998.

Anyhow, a growing heterogeneity in regional TFP (in average: loosing performance) and a corresponding tendency of regional polarization can be found in agriculture too. The obvious reasons for that pose another interesting aspect.

The mentioned regional divergence in TFP trends for the economy as a whole (industry and service sector in particular) refer predominantly to differences among the individual TCH. On the other hand, the TE is relative homogeneously and causes just a periodicity in the main trends. In contrast, for agriculture the TCH is very homogeneously and the individual developments of TE provide the polarizing trends. Its a matter of fact, marginal regions are deteriorating and the other regions just keep their TE levels. This should be an alarming signal since it emphasizes how difficult it is still to be successful in proceeding a regional transition process (esp. for agricultural dominated regions respectively rural areas).

On this background automatically the questions arise: What are the determinants which affect such a diverging process? And, what are the critical factors of success in Russia's regional transition? In order to answer those questions a comprehensive regression model has been applied (see above, analytical step II).

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[13] Positive effects of liberalization (phase I) have led to growing TFP (phase II). Obviously, this has been overcompensated by effects of hyperinflation, demonetarisation, and currency crisis (phase III). Later on, the positive effects initiated by the 'window of opportunity' (phase IV) have led to rising TFP again.

[14] This becomes even more clear if industry or service sector instead of entire economy is used as benchmark.

First of all, the importance of a generally promising environment for any economic activity was emphasized by the fact that apparently the TE of any sector is substantially affected by the level of TE in all the other sectors. Hence, this is a call for policies which focus on business development in a general manner instead of certain sectoral subsidization (like e.g. 'assisting' agriculture to overcome the evident transition problems). Moreover, considering the regional characteristics of *current stage of reforms* (variable [SR], different approximations) has shown: Regardless which sector has been analyzed, in general, the reform leaders performed better than the remaining regions! Besides, the regional transition process certainly was significantly affected, for example, by the mean regional *level of welfare* [WF], availability of *human capital* [HC][15], regional *technological level* [TL], and *degree of opening* [OD] toward external markets.[16]

All these variables refer to certain institutional environmental conditions which are apparently quite different due to peculiarities[17] among the regional reforms. Accordingly, between these differences and the polarizing tendencies mentioned above there seems to be a causal connection. Knowing that, what call for actions can be deduced? What to do in reference to reform policies and/or their agenda?

In contrast to the widespread established opinion in Russia the directly arisen call for actions have to be addressed mainly to the regional level! First of all is has to be mentioned that frequently no clear vision and, least of all, no consistent reform concept[18] regarding regional development exist. But a common consensus about these questions is basically and must be considered as a precondition for any successful mid/long-term political program focusing on enhancements of regional perspectives. Simply: Without a clear objective any target is difficult to tackle. And, obviously, this has to be addressed regionally. Moreover, out of the result 'reform leaders perform better than the rest' one can directly deduce the call for strengthen the regional reform efforts. Thereby, especially for the marginal regions, a substantial part of the initial performance gap might be closing when the institutional settlements made by the reform leaders simply will be copied. Quasi: Takeover the best practicing example instead of keep ongoing try and error in performing reform measures. And this is again a regional task.

Summarizing, the quality of the regional institutional environment has to be improved because – this has the study shown as well – a comprehensive transfer system what might balance inter-regional differences seems to be more than unlikely for Russia's nearest future. Therefore, regions increasingly have to compete, for example, in terms of investors. Success on this filed will probably distinguish between regional "winners" and "losers" of the transition process.

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15 Thereby negative effects due to migration were specified as the main causal reason. High-capable / educated people migrate first what force an additional intensification of the sloped regional human capital and/or welfare distribution. This process seems to be self-energizing and, therefore, force regional polarization.

16 [OD] and [TL] correspond directly/indirectly to the access to new technologies, investments and, in particular, to co-operations with foreign partners which was considered to be stimulating in general.

17 According to the reform objective, its way of implementation, timing / agenda , strictness, etc..

18 Verbalization of a individual (regional) vision regarding spatial development policy, performing of adjusted policy measures in order to catch this vision, and, finally, embedding these measures in a reform agenda.

5 Conclusions

Altogether it can be mentioned: By reflecting a decade of transition in Russia there is no clear pattern yet with respect to increasing productivity/efficiency like it was expected from theoretical point of view when a planned economy is turning toward a market oriented ones (see introduction). Instead, the sectoral and even more the regional transition paths are considerable heterogeneously. Occasionally, they even diverge and provide, however, a growing economic polarization among Russia's regions. Background of this trends are, above all, spatial divergent institutional environmental conditions caused by various ways of reform implementation and/or reform strictness. Hence, the crucial call for political action had to be addressed regionally.[19]

Accordingly, the general conclusions are: The essential pre-conditions – means the general framework – for transition in Russia has been fixed. But there is apparently a need in some regions for an adequate individual adjustment as well as, sometimes, for a sustainable stimulus in order to change towards the positive. Hence, the particular embodiment of the regional transition path, the political initiative, and, therefore, any success on Russia's way from a 'planned towards a market economy' are incumbent on the regions. Admittedly, those have to be aware of own potentials. The regions should develop their individual chances actively and, however, try to turn specialties into benefits. Since this will be successful, it can be a source of substantial growth at regional as well as at federal level.

[19] Like, for example, regional encouragement of human capital, opening of regional markets for foreign investors, technological transfers, and for competition too.

APPENDIX

Table 1: Selected regressor variables regarding TE as well as TW

variable proxy	regressor for		differentiation, approximation, statistical preparation	(statistical) source
	TE	TCH		
TEMP	x	-	temperature (agriculture only	GOSKOMSTAT(1)
RAIN	x	-	Average of annual amount of rainfall in a certain region (agriculture)	German Climate-Atlas
TE_{Sector}	x	-	TE-scores of the remaining sectors	Own calculations
S_CH	x	x	Sum of annual inter-sectoral movements of employees per regions (*Structural Changes*)	GOSKOMSTAT(1) Own calculations
TL_{TE}	x	-	regional fixed assets per capita	GOSKOMSTAT(1) Own calculations
TL_{TW}	-	x	annual regional level of investments / capita by sectors	GOSKOMSTAT(1) Own calculations
$SR_{TE}1$	x	-	sectoral share of deficit-making enterprises	GOSKOMSTAT(1)
$SR_{TE}2$	x	-	regional share of privatized enterprises	GOSKOMSTAT(1)
$SR_{TE}3$	x	-	regional share of barter-trade (according to total turnover)	IAMO-STUDY(2)
$SR_{TE}4$	x	-	paid fees per total household income (share) * average regional real wage (in purchasing power parities [PPP])	GOSKOMSTAT(1) Own calculations
OD_{TE}	x	-	regional share of employees in foreign enterprises	GOSKOMSTAT(1) Own calculations
OD_{TW}	-	x	foreign investments per capita by region	GOSKOMSTAT(1) Own calculations
WF	x	x	trend of real wages per region [in PPP]	GOSKOMSTAT(1) Own calculations
IQ_{TE}	x	-	aggregated density of roads and railways by region [km length / Tkm^2]	GOSKOMSTAT(1) Own calculations
HC	x	x	number of postgraduates / 1000 inhabitants by region	GOSKOMSTAT(1)
EQ_{TE}	x	-	number of diseases / 1000 inhabitants	GOSKOMSTAT(1)
EQ_{TW}	-	x	Balance sheet of environmental pollution (toxic emissions) by region	GOSKOMSTAT(1)
POL	x	x	share of votes for reform-oriented parties in the Duma-elections (1995-1998, → 1999)	Own calculations (3)

Notes: (1) Several Russian Statistical Yearbooks (regional, federal), various editions (1996-2001), GOSKOMSTAT.
(2) This has been analyzed within another IAMO-study (see for details: O. DOLUD, forthcoming).
(3) http://pubs.carnegie.ru/elections/president2000/book/pics/apex04.asp

Source: Own illustration. Regarding the origin of data see notes in / below the table.

Table 2: SFA-coefficients for Russia's agriculture and the economy as a whole

agriculture parameter for a Translog-production-frontier-function					reduced model (two inputs)	**Economy as a whole** parameter for a Translog-production-frontier-function			
variable	coefficient	standard error	T-value	P-value	variable	coefficient	standard error	T-value	P-value
$\beta_{0\ (intercept)}$	0.1868	0.0274	6.823	0.0000	$\beta_{0\ (intercept)}$	0.1902	0.0186	10.222	0.0000
β_t	-0.0122	0.0043	-2.819	0.0048	β_t	-0.0053	0.0039	-1.345	0.1785
β_{tt}	0.0128	0.0042	3.060	0.0022	β_{tt}	---	---	---	---
$\beta x_{1\ (Capital)}$	0.2973	0.0274	10.829	0.0000	$\beta x_{1\ (Capital)}$	0.4074	0.0362	11.250	0.0000
$\beta x_{2\ (Labor)}$	0.4146	0.0275	15.053	0.0000	$\beta x_{2\ (Labor)}$	0.6873	0.0317	21.663	0.0000
$\beta x_{3\ (Fertilizer)}$	0.0822	0.0120	6.864	0.0000					
$\beta x_{4\ (Land)}$	0.1386	0.0123	11.258	0.0000					
$\beta t,x_1$	0.0039	0.0096	0.404	0.6859	$\beta t,x_1$	-0.0324	0.0136	-2.384	0.0171
$\beta t,x_2$	0.0011	0.0103	0.110	0.9120	$\beta t,x_2$	0.0435	0.0132	3.285	0.0010
$\beta t,x_3$	-0.0028	0.0052	-0.540	0.5894					
$\beta t,x_4$	-0.0008	0.0045	-0.175	0.8614					
$\beta x_1,x_2$	0.1855	0.0647	2.869	0.0041	$\beta x_1,x_2$	0.0370	0.1678	0.220	0.8256
$\beta x_1,x_3$	0.0107	0.0273	0.392	0.6951					
$\beta x_1,x_4$	-0.0530	0.0268	-1.977	0.0481					
$\beta x_2,x_3$	-0.0064	0.0256	-0.250	0.8027					
$\beta x_2,x_4$	0.0429	0.0359	1.196	0.2315					
$\beta x_3,x_4$	-0.0190	0.0146	-1.294	0.1955					
$\beta x_1,x_1$	-0.0999	0.0652	-1.533	0.1252	$\beta x_1,x_1$	0.0136	0.1679	0.081	0.9356
$\beta x_2,x_2$	-0.2875	0.0915	-3.141	0.0017	$\beta x_2,x_2$	-0.0747	0.1683	-0.444	0.6571
$\beta x_3,x_3$	0.0016	0.0173	0.091	0.9278					
$\beta x_4,x_4$	-0.0041	0.0177	-0.232	0.8167					
μ / σ_u	1.7893	1.3654	1.310	0.1900	μ / σ_u	---	---	---	---
$Lambda^2$	3.5179	0.6574	5.352	0.0000	$Lambda^2$	2.1413	0.3790	5.651	0.0000
$Sigma^2(v)$	0.4871	0.0981	4.963	0.0000	$Sigma^2(v)$	0.2765	0.0155	17.791	0.0000

Source: Own calculations. Estimations has been made by using LIMDEP 7.0. See for details VOIGT (2003, 2004) and, with particular respect to the implementation in LIMDEP: GREEN (2002).

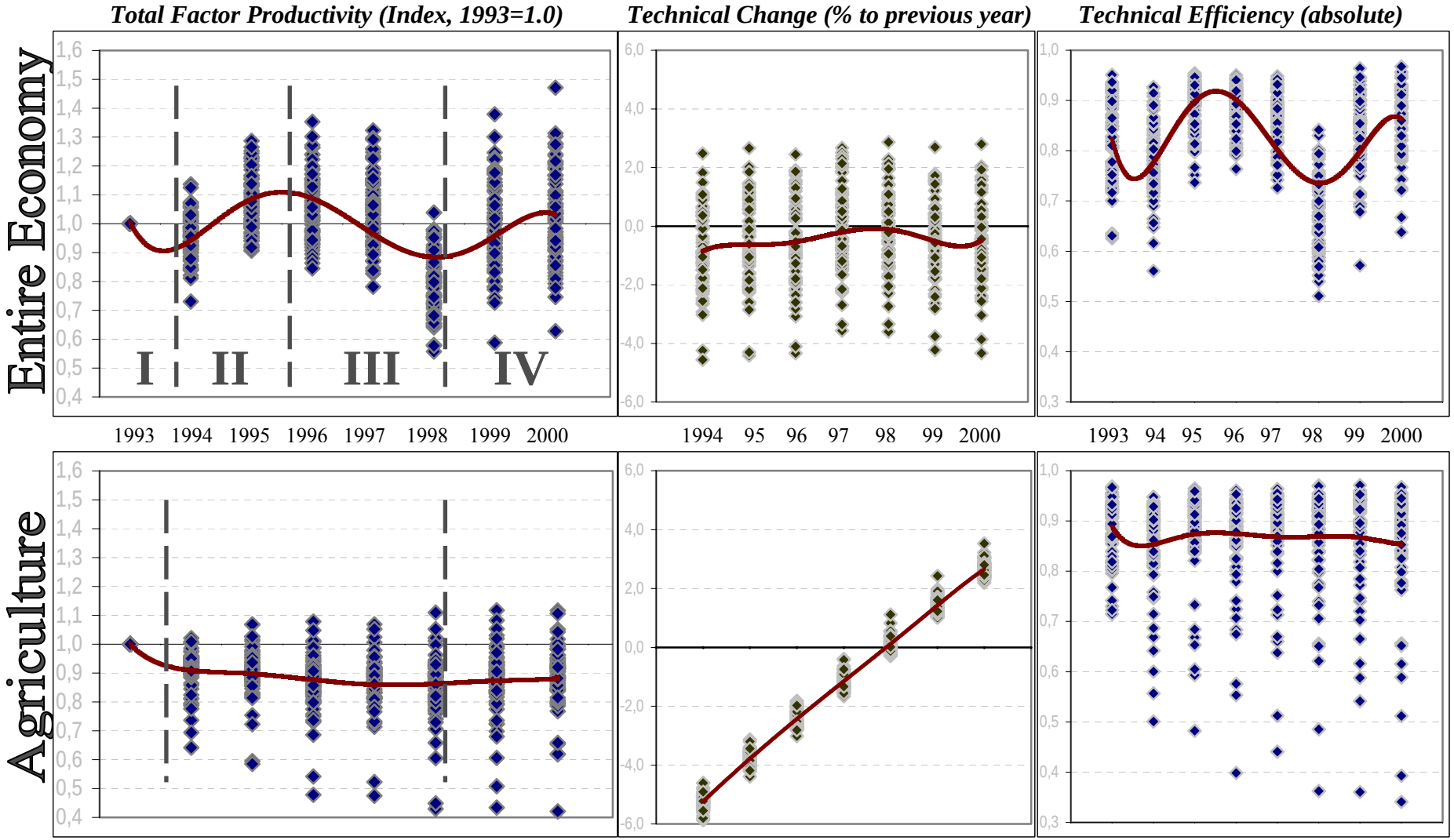
Table 3: Parameter of the regression model for Russia's agriculture (analytical step II)

	TW		TE	
	Basic model	reduced model	Basic model	reduced model
TEMP	---	---	-2.21E-03 [0.1357]	...
RAIN	---	---	6.05E-05 [0.3024]	...
$TE_{Industry}$	---	---	5.11E-01 [0.0000]	5.74E-01 [0.0000]
$TE_{Agriculture}$	---	---	---	---
$TE_{Construction}$	---	---	3.03E-01 [0.0000]	3.46E-01 [0.0000]
$TE_{Services}$	---	---	1.11E-01 [0.0511]	1.36E-01 [0.0014]
S_CH	-1.14E-04 [0.0479]	...	3.28E-04 [0.0005]	2.89E-04 [0.0002]
$TL_{Entire\ Economy}$	---	---	2.35E-04 [0.3461]	...
$TL_{Industry}$	-8.89E-02 [0.0000]	-9.60E-02 [0.0000]	---	---
$TL_{Agriculture}$	6.33E-01 [0.0000]	6.79E-01 [0.0000]	---	---
$TL_{Construction}$	-1.05E+00 [0.0000]	-1.12E+00 [0.0000]	---	---
$TL_{Services}$	5.09E-01 [0.0000]	5.36E-01 [0.0000]	---	---
$SR1_{Industry}$	---	---	-5.34E-04 [0.2518]	...
$SR1_{Agriculture}$	---	---	3.62E-04 [0.3603]	...
$SR1_{Construction}$	---	---	-2.85E-05 [0.8983]	...
$SR1_{Services}$	---	---	8.89E-05 [0.4139]	...
SR2	---	---	-2.98E-04 [0.0335]	-2.70E-04 [0.0010]
SR3	---	---	-1.06E-05 [0.4575]	...
SR4	---	---	-2.63E-04 [0.0029]	-3.20E-04 [0.0000]
OD	-2.75E-04 [0.0000]	-2.64E-04 [0.0000]	-1.58E-05 [0.4765]	...
WF	1.07E-04 [0.0000]	1.07E-04 [0.0000]	3.60E-05 [0.0008]	4.12E-05 [0.0000]
IQ	---	---	6.79E-06 [0.3966]	...
HC	5.54E-01 [0.0000]	5.48E-01 [0.0000]	1.41E-01 [0.0001]	1.03E-01 [0.0002]
EQ	9.23E-06 [0.3877]	...	6.29E-05 [0.2451]	...
POL	4.42E-05 [0.3953]	...	-4.68E-06 [0.8368]	...

Note: [x.xxxx]-scores refer to the corresponding P-value (probability of H_0: [Parameter=0]),
'---' corresponding regressor has not been implemented due to theoretical reasons,
'...' corresponding regressor has been eliminated due to statistical insignificance.

Source: Own calculations based on the results of an appropriate recursive tow-equation-regression-model for capturing the effects within the agricultural sector of Russia. Due to the lack of space here a presentation of any results of the remaining sectors – considered accordingly – had to be skipped. The calculations are based on LIMDEP 8.0. See, again, GREEN (2002).

Figure 1: Illustration of the regional individual developments (*dots*) **as well as trends** (*lines*) **of: Total Factor Productivity [TFP], Technical Change [TCH], and Technical Efficiency [TE] for Russia's entire economy** [*graphs above*] **as well as its agriculture** [*below*]



Source: Own calculations and illustrations.

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